A.D. 1861, *25th September.* N° 2395.

Telegraphic Apparatus.

LETTERS PATENT to Alfred Vincent Newton, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, for the Invention of "Improvements in the Construction of and Mode of Working Telegraphic Apparatus."—A communication from abroad by Giovanni Caselli, of Florence, in the Kingdom of Italy.

Sealed the 19th November 1861, and dated the 25th September 1861.

PROVISIONAL SPECIFICATION left by the said Alfred Vincent Newton at the Office of the Commissioners of Patents, with his Petition, on the 25th September 1861.

I, Alfred Vincent Newton, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, do hereby declare the nature of the said Invention for "Improvements in the Construction of and Mode of Working Telegraphic Apparatus," to be as follows:—

This Invention relates to improvements in electric telegraphic apparatus, whereby through the synchronous movements of weighted pendulums at the transmitting and receiving stations telegraphic communications may be rapidly transmitted. The pendulums of the transmitting and receiving instruments severally oscillate between two fixed electro-magnets, which are alternately magnetized and demagnetized by the action of an electric battery, and are thereby caused to act upon the armatures of their respective pendulums. The

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battery which maintains this pendulum movement serves also to put the two corresponding instruments into telegraphic communication, but the current which may always circulate in the line wire only acts on the magnets at the end of each oscillation. Each instrument is provided with a regulating apparatus, consisting of a clock movement, the pendulum of which makes two oscillations for every oscillation made by the pendulum of the instrument which it regulates. The current from the transmitting battery is first passed through a circuit breaker contained in this apparatus, and then admitted to the transmitting apparatus, where by means of the pendulum it sets in operation the pantelegraph mechanism, presently to be noticed, and ultimately passes by the line wire to the receiving instrument fitted with a counterpart of the pantelegraph mechanism. To operate the circuit breaker of the regulating apparatus, a separate small battery is used which sends a current into an electro-magnet that draws down a lever, and thus completes the circuit for the main current. The circuit of this auxiliary battery current is made by the beat of the regulator pendulum, a spring being interposed which forms a conductor when touched by a pin carried by the pendulum. The pressure of this spring is adjusted by a micrometric screw for the purpose of regulating the pulsations of the regulator pendulum to the greatest nicety, and thus through the circuit breaker timing the pulsations of the instrument under its control so as to produce a synchronous movement between the transmitting and receiving instruments.

Each instrument is provided with a duplex pantelegraph arrangement, consisting mainly of two segment-shaped tables for receiving respectively the chemically prepared paper containing, and that intended to receive the message to be transmitted, also of two traversing styles or pointers working on a slide, and carried by a rock lever. This rock lever is operated by the pendulum to which it is coupled by a connecting rod, and thus the style which at the same time receives a progressive motion from a rotating screw shaft (operated by a click and ratchet wheel) is traversed up and down over the paper. At the completion of every oscillation of the pendulum a current of electricity is sent through the paper when metallic contact is made by the style, and this current passing to the line wire, and so to the receiving instrument, a chemical change is made in the paper at the point of contact of the style, the frequent repetition of which will produce a counterpart of the message intended to be transmitted in colour or in white, as will be well understood. Each instrument being similarly provided with a duplex pantelegraph apparatus, the forward and backward oscillation of the pendulum is available, the one for

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obtaining a message and the other for transmitting a message simultaneously in opposite directions, two batteries being employed for that purpose, and the styles being alternately rocked to throw them into and out of action. The instruments are also fitted with audible signal apparatus, which is operated by the electric current, the circuit being made and broken by the beat of the pendulum on swing levers, which press spring circuit breakers into metallic contact for completing the circuit for operating the pantelegraph apparatus. It will be understood that every time the style of the transmitting instrument, in passing over the chemically-prepared paper, comes in contact with ink lines forming the written message, a break takes place in the circuit, and the current is diverted into the line wire. When the line wire is not receiving the current from the main battery, a weak current passes along it in the opposite direction from the auxiliary battery before mentioned, which current serves to give distinctness to the telegraphic characters.

As a modification of the pantelegraphic apparatus (with the view of obtaining copies of telegrams written in Morse characters) it is proposed to use a cylindrical table to receive the message on prepared paper, and to impart an intermittent axial motion thereto to bring the paper under the point of the styles, which are carried by a sliding bar, and receive a lateral traverse motion through a segment rack operated by the pendulum of the instrument, and working into rack teeth on the sliding bar. The styles which are intended alternately to act are jointed to a sliding rod carried by the sliding rack bar, and by that rod are alternately rocked into and out of action. An electric current passing through the apparatus, and thence by the line wire to the receiving instrument, acts upon the chemically-prepared paper of the receiving instrument, as already explained, and reproduces the telegram thereon.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Alfred Vincent Newton in the Great Seal Patent Office on the 25th March 1862.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, ALFRED VINCENT NEWTON, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Mechanical Draughtsman, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-fifth day of September, in the year of our Lord One thousand eight hundred and sixty-one, in the twenty-fifth year of Her

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reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Alfred Vincent Newton, Her special license that I, the said Alfred Vincent Newton, my executors, administrators, and assigns, or such others as I, the said Alfred Vincent Newton, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE CONSTRUCTION OF AND MODE OF WORKING TELEGRAPHIC APPARATUS," being a communication from abroad by Giovanni Caselli, of Florence, in the Kingdom of Italy, upon the condition (amongst others) that I, the said Alfred Vincent Newton, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Alfred Vincent Newton, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the Drawing hereunto annexed, and to the letters and figures marked thereon (that is to say):—

This Invention relates to a novel arrangement of mechanism for transmitting currents of electricity, and termed by the Inventor the "Pantelegraph," which mechanism depends for its accurate operation on there being a perfect accord or synchronism between the oscillations of the pendulums of two connected instruments placed at distant stations, the metallic circuit between the stations being made and broken, as is well understood by the oscillations of such pendulums. This desired accord in the action of the pendulums it is now proposed to obtain by the pressure of a spring regulated by a micrometric screw.

The Invention also relates to the employment of a special arrangement of the electric battery by means of which, after every interruption of the principal telegraphic current, a weak current in the contrary direction is produced in the line wire.

And the Invention further relates to an arrangement of mechanism specially applicable to the copying of telegrams in Morse or similar characters.

By the application of this Invention the following results may be produced,

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vizt., firstly, colored letters or characters are obtainable upon white paper direct by the line current without any local battery or relay, and from original writing in ordinary ink; secondly, despatches may be reproduced, either of the same size as the originals or reduced, the character of the original writing being at the same time retained; thirdly, different messages may be simultaneously transmitted through a single line wire; fourthly, telegrams written in Morse or similar characters may be reproduced by electro-chemical action.

In the accompanying Drawing Figures 1 and 2 represent an instrument with its batteries complete or set up at one station; and Figures 3 and 4 represent a similar instrument with its appliances as arranged for a distant station, the two instruments being connected by means of a line wire; details of certain portions of these instruments are shewn more clearly at Figures 5, 6, 7, and 7*, as also in the edge view Fig. 8, and the plan view Fig. 9. A, B, Fig. 2, is a pendulum, six feet in length, provided at its lower extremity with a rectangular piece of iron *b*, and a piece of lead *c*, weighing twelve pounds. This pendulum is mounted in a cast-iron framing or standards C, D, E, F, to which it is attached by a pendent strip of thin metal *g**, or it may be simply hung on a pivot. K is a battery, the current of which passing from the positive pole +, arrives at the button 3 of the regulating apparatus, Fig. 1, follows the wire *d*, *d*, and after having traversed a magnetic apparatus M, returns to the button N. The current thence passes through the cable O to the point *e*, Fig. 2, where it is divided into two conducting wires, which terminate at the small copper plates *a* and a^1. The pendulum A, B, being in the position shewn in the Drawing (that is midway between two fixed electro-magnets H and I,) the current will be interrupted at the said plates of copper *a* and a^1, which are mounted upon pieces of wood or other insulating material, but so soon as the pendulum (being made to deviate from its perpendicular position) follows the direction of the arrow *e**, *e**, it will, on arriving nearly at the end of its course, cause the arm *f*, *w*, to press against the ivory button *g*, which is carried by a small pendent lever, and thereby through the forward movement of that lever establish contact between a spring *h* and the plate *a*. The current will now pursue its course through the wire *s*, *s*, to the magnet H, and having passed through the coil surrounding that magnet, it will pass up through the wire *i*, *i*, to the spring *m*, and through the stud *n* and lever Q to the framing C, F, D, E, thence to a wire screwed to the framing at 2, (Fig. 2,) and through the cable O, O, to the button 2, Fig. 1, and back to the negative pole of the battery K, through the conducting wire *f*. If the pendulum be caused to advance in the opposite

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direction, the arm *f*, *w*, will act upon the button g^1, and the current from the battery K will then pass through the coils of the electro-magnet I. Thus, by causing the pendulum to be deflected to the right or the left as soon as it arrives at the end of its course, it is firmly retained by the attraction of one of the electro-magnets H or I, the magnetism of which reacts upon the piece of iron *b*. The wooden box P, P^1, (Fig. 1,) contains a clockwork movement or ordinary regulator P^{11}. The length of the pendulum of this regulator is adjusted in such a manner that it makes somewhat less than two oscillations during the time that the large pendulum A, B, is making only one oscillation. The current of the battery 4, starting from the positive pole +, passes through the electro-magnet M, and thence through the circuit breaker or commutator 4^1 and wire p^* to the spring *u*. Every time that the metal stud *s*, by the oscillation of the regulator pendulum, touches the spring *u*, the current passes into the wire *r*, *r*, by which it returns to the battery L. The successive currents given off at each double oscillation of the regulator pendulum magnetise the electro-magnet M, which by attracting the iron lever *t*, instantly breaks the circuit of the battery K, the resulting demagnetization of the magnet H allows the pendulum A, B, to fall by its own gravity, and it being afterwards attracted by the magnet I, remains at rest a fraction of a second, and again falls by the constantly repeated action of the regulator P^{11}. The oscillation of the pendulum A, B, is thus maintained for any desired length of time. It may be remarked that the action of this regulator would be much more simple if instead of employing the battery L for the purpose of breaking the circuit of the battery K, this were effected directly by the pressure of the pin *s* upon the spring *u*, by attaching the wire *r*, *r*, to the insulated piece I, but long experience has shewn that the action of the commutator M being very prompt and rapid, the oscillations of the large pendulum A, B, were by this means more regular and isochronous. In order to arrest at pleasure the movement of the pendulum A, B, it is only necessary to turn to the left the small lever L^1, Fig. 1. The circuit of the secondary battery L being thus broken permanently, the pendulum remains fixed by one or the other of the two magnets H, I, according to whether its last oscillation was to the right or the left.

When it is desired to stop the action of the machine for a long time, the lever Q, Q, is to be raised by bringing it to the position of the dotted line. This movement of the lever produces two results, it stops the pendulum mechanically either to the right or left, and breaks the circuit of the battery K. In order perfectly to understand this result, reference should be had to Fig. 2,

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and also to Fig. 7*, which represents the said mechanism in plan view. The double lever *p*, *p*, which is hung on the pendulum by the pivot p^1, is held in its horizontal position by the spring *r*, and near its extremities, which are hook-shaped, it carries two ivory studs *c*, *c*. When the pendulum is retained to the right or the left by the action of the magnets H, I, if the lever Q be raised, one of the extremities of the lever *p*, *p*, will take into the stop piece *q*, and by being hooked on to it, will keep the pendulum in its oblique position, at the same time the ivory stud *c*, *c*, bearing upon the spring *m*, will move away from the metal pin n^1, and interrupt the current conducted by the wire *i*, *i*. The same battery K, which maintains, as has been explained, the movement of the large pendulum A, B, serves also to establish telegraphic communication between the two corresponding stations. As soon as either of the electro-magnets H, I, ceases to retain the pendulum, the current starting from the pole + of the battery K is conducted to the button 3, and as it cannot pass out through the wire *d*, *d*, it enters the cable O, O, which is composed of four copper wires covered with caoutchouc. The current passes out of the cable by the wire 3 (Fig. 2), thence through the copper lever *z*, the stud *n*, and lever *g*, and through the wire s^1 to the lever g^1. From this lever it passes, by means of the wire 1, into the cable O, O, out from thence by the button 1, Fig. 1, and after having passed through the battery Z, again enters the line wire, which conducts it to the apparatus Fig. 4, situate at the other station. After having produced in this machine the effects about to be described, it returns through the earth to the plate *p*, *l*, Fig. 1, and through the button 2, returns to the negative pole of the battery K.

In order to shew clearly the effects produced by the line current at the receiving station, it is necessary to refer to certain parts of the machine not yet explained. The movement of the pendulum A, B, is transmitted by means of the link W to a lever *y*, *y*, which rocks upon a fulcrum *x* supported in bearings attached to a bracket of the main framing (see the detached sectional view Fig. 7, and side view Fig. 5). This lever *y* carries the marking apparatus, which consists of the following parts:—Two right and left handed screws *b*, b^1, coupled end to end, and mounted in a frame attached to the upper part of the lever form the shaft of a ratchet wheel *c*, which is keyed thereto. The lever *y* carries also a pallet lever *i*; *u*, *u*, two limbs of which embrace the ratchet wheel *c*, while the pendent tail of the lever is situate between two fixed screws attached to the main framing of the instrument. As, therefore, the lever *y* is rocked on its fulcrum *x* by the connecting rod which couples it with the pendulum A, B, the tail *i* will strike against one of

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the screws *e*, *e*, which are intended to limit its movement, while the pallets *w*, *u*, will communicate an axial motion to the ratchet wheel *c*, and through it to the screws *b*, b^1; working into the threads of these screws are the threaded caps c^1, c^1, which are affixed to slides *d*, d^1, supported by guide bars e^1, e^1. These bars are in the form of a rectangular prism, but they are rounded at their extremities to allow of their turning in their bearings in the frame A, C, (Fig. 5). These bars will turn either to the right or the left according to the direction in which the pallet lever is rocked, and will alternately raise and lower the arms b^1, b^1, (Fig. 6,) attached to the slides *d*, d^1, which arms carry at their extremities a point or style v^1; *t*, t^1, are segmental tables shewn in side view at Fig. 5, and in edge view at Figures 2 and 7. These tables are made of tin, and are carried by a bracket of the main framing; the centre of their arc is at the point *x*. From the above detailed description of the apparatus it will be readily understood that when the pendulum A, B, oscillates the two styles *v*, v^1, will alternately rise and fall simultaneously, and that at the completion of each oscillation of the lever *y* they will receive a lateral or shogging motion. Thus the successive beats of the pendulum will cause the styles alternately to describe upon the paper, or other surface laid upon the segment tables, parallel arcs of circles at a certain distance from each other. The number of teeth of the ratchet wheel *c* and the pitch of the threads of the screws it is preferred so to arrange that this distance shall be about one sixty-fourth of an inch. G, H, Fig. 5, are counterweights for the purpose of maintaining equilibrium between the two arms of the lever *y*, *y*. It now remains to observe the effect of the line current which at each oscillation of the large pendulum (Fig. 2) arrives, as has been shewn at the receiving instrument, Fig. 4. This current being positive first meets with the battery *z*, Fig. 3, the poles of which are turned in a direction contrary to it. If the batteries K, Figures 1 and Z, Fig. 4, were of the same power, and if the line wire were perfectly insulated, the two opposite currents would mutually destroy each other; but as the battery Z only has one or two elements, whilst the battery K is composed of a much larger number, the result is that the line current entirely destroys the other, and is only slightly weakened by its resistance. The current after having passed to the button 1, Fig. 3, enters the cable O, O, passes therefrom through the wire 1, Fig. 4, to the lever g^1, thence through a wire to the lever *g* and spring *h*, and by the wire z^1 back to the lever *y*, *y*. It should be observed that this lever is insulated from the cast-iron framing by pieces of wood 4, seen more clearly in Fig. 5. From the rock lever *y*, *y*, the current passes to the style *v*, and thence to the segment table *t*, *t*, mounted upon the cast-iron framing, and back

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again to the screw to which the wire 2 is attached. This wire after passing through the cable O, O, passes to the button 2, Fig. 3, and again arrives at the earth through the plate *p*, *l*. The circuit being thus established between the two telegraphic stations, the two iron styles *v*, *v*^{1}, will remain electrified during the whole time that they pass over, and in contact with the tin segment tables *t*, *t*, *t*^{1}, *t*^{1}. If the surface of these segments be covered with sheets of paper steeped in a solution of ferrocyanide of potassium, the iron styles being positively electrified will decompose the said cyanide, and trace lines of a light-blue tint, which will gradually cover the whole surface of the paper. The coloring thus produced by the battery placed at the other station can only be discontinued by the interruption of the line current. This takes place, as will be readily understood, by the action of a strip of silvered paper containing the message, a fac-simile of which it is desired to reproduce at the receiving station; the message having been previously written thereon by means of an ordinary pen and ink. This paper having been placed upon the segmental table *t*, *t*, Fig. 2, notice is sounded at the other station by a bell, and the transmitting and receiving instruments are set in motion by the mechanism already described with reference to Figures 1 and 3. It should be first remarked that when the point *v* (which should be made of platinum) passes over the silvered surface of the paper without coming in contact with the written characters, the current of the battery K cannot circulate in the line wire. In fact on starting from the positive pole it passes to the button 3, Fig. 1, through the cable to the wire 3, Fig. 2, passes through the brass lever *z*, the wire *z*^{1}, the double lever *y*, *y*, and the platinum style *v*, thence through the silvered paper into the segmental piece *t*, through the cast-iron framing to the screw 2, enters the cable, passes from it to the button 2, Fig. 1, and returns to the negative pole of the battery K. But every time this style comes in contact with the ink lines, as that substance is a non-conductor, the electric communication is interrupted, and the current of the battery K not being able to pass out on that side enters the line wire, following the course already pointed out, and passes to the receiving station, where it produces the coloring of the chemically prepared paper. When the movements of the pendulums placed at the two corresponding stations are perfectly synchronous, the arrangement of the blue lines will be identical with that of the ink lines forming the original despatch. If their movement were not perfectly synchronous the result would be that the copy of the writing would not have exactly the same form as that of the original, but it would be more or less inclined to the right or the left according to whether the oscillations of the

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pendulum of the receiver were slower or faster than those of the pendulum of the transmitting apparatus. In order to maintain the synchronous action at the minimum fraction of a second, it is necessary from time to time to react upon the pendulum of the regulator P^{11}, Fig. 3, so as to augment or diminish the duration of its oscillations. This is readily effected by means of the spring *u*, the pressure of which upon the point *s* fixed upon the pendulum of the regulator may be increased or diminished by the micrometric screw *v*, upon which is fixed the index *i*. On turning the button *n* of this screw the index or pointer will pass over the divisions of a graduated arc on the side of the box P, P, (but not shewn in the Drawing). If the pressure of the spring *u* be increased by turning the index some degrees to the right, the movement of the pendulum will be sensibly accelerated, and if on the contrary the index be moved to the left, its movement will be retarded. By this means, which is extremely simple, perfect synchronism (which is an essential condition for the perfect reproduction of writings or drawings) is obtained; but identity in form between the characters of the original and those of the copy is not the only condition necessary for the perfect reproduction of telegrams; the lines of the writing or drawing must also be clear and well defined. This is attended with difficulties, especially when the operation is carried on at great distances. To obtain clearness in the reproduction of pantelegraphic dispatches, the action of a weak current in a contrary direction to that of the line current is employed. This weak current is developed from the battery L, Fig. 3, at each interruption of the circuit of the battery K, Fig. 1. It is not necessary to explain in what manner this negative current from the battery L may be produced, as it has been already shewn that the action of that battery is only prevented by the passage of the principal current which starts from the other station. The effect of this counter-current is to depolarise the iron style v^1, and immediately to arrest its chemical action upon the surface of the paper.

In order simultaneously to transmit two different despatches, the originals are to be laid upon the two segments of cylinders *t*, *t*, and t^1, t^1, of the instrument represented at Fig. 2. The friction of the styles *v*, v^1, upon the surface of the two despatches being alternate, the lines of the one cannot be confounded during their reproduction with those of the other, and they are reproduced separately and at the same time upon the chemical papers placed upon the segments of the instrument, shewn at Fig. 4.

From the foregoing description, the instrument Fig. 4 would appear to be the receiver, and the instrument Fig. 2 the transmitter; it must, however, be remarked, that the two instruments are similar in construction, that the only

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difference between that which transmits and that which receives the telegrams being, that in the one the position of the lever Z (as in Fig. 2) is turned to the left, whilst (as in Fig. 4) it is turned to the right. In order to transmit despatches from the instrument Fig. 4 to that shewn at Fig. 2, it is only requisite to place these levers *z* in an inverse position, and to change the styles, those which glide over the originals being made of platinum, and those which touch the chymical papers of iron.

In order to produce telegraphic copies of a size less than that of the originals, a duplicate of the apparatus carried by the bracket M, M, must be provided and set up on a bracket at N, N, on the right-hand side of the instrument, the duplicate apparatus being similar to that shewn (with the exception of the bell apparatus E), but of smaller dimensions. Supposing the segmental piece t^1, t^1, Fig. 7, to have a radius of five inches, and the ratchet wheel *c* to have eighteen teeth, if it were required to reduce the breadth of the copy of the despatch by one-sixth, the radius of the new segmental piece must be four inches, and the wheel *c* must have fifteen teeth. In this case, by employing the apparatus at the right side of the instrument as the receiver, telegrams on a reduced scale would be obtained, reproducing faithfully the form and proportions of the original writing. This arrangement might be of great utility, especially between stations situate at great distances apart, as the electric action being concentrated upon a surface of less extent, the despatch will be well marked and legible, even supposing the line current to be much weakened. The bell or signal apparatus E, Figures 2 and 4, can only work whilst the pendulums A, B, of the two instruments are stopping, provided that the levers Q, Q, are placed in the direction of the dotted lines. On pressing with the finger upon the stud *o* of one signal apparatus, it is easy to follow upon the Drawing the course of the current of the battery K, in order to arrive at the magnet of the signal apparatus, which is at the other station.

Figures 10, 11, and 12, represent an apparatus which is added to that above described, in order to obtain copies of telegrams previously written with a pen in Morse's characters on metallized paper. A band of tinned or silvered paper about four inches broad, and which may be even a yard in length, is laid over a cylinder A, B, Fig. 10, which is mounted on a shaft *c*, *d*, and turns by the action of a weight *e*. The rotation of this drum is governed by stops or pallets e^1, f^1, working the teeth of an escape wheel attached to the cylinder A, B. At the side of the iron standards C, D, E, F, of the receiving and transmitting instrument, and at a distance of about three feet therefrom is placed the apparatus here described, the two conducting wires *b*, *r*, of this apparatus

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being connected to the points *x* and 2 of the instrument, Figures 2 and 4. The connecting rods *g*, *g*, which is about three feet long, is attached to the pendulum A, B instead of the rod *w*, which is detached from the apparatus. On putting the pantelegraph into action in the ordinary manner, the bar *h*, *i*, (Figures 10 and 11) will receive a reciprocating movement from a segment rack *s*, which has a rocking movement corresponding to that of the pendulum. At the same time the segment rack *s* gearing into rack teeth on the bar *h*, *i*, the points *v*, v^1, will fall and rise alternately by the action of the double lever *n*, which is mounted in brackets attached to the bar *h*, *i*, and strikes against the screws *m*, *m*. This lever *n* is connected by means of a horizontal rod *o*, *o*, with two rock levers h^1, h^1, which carry respectively the styles *v*, v^1, Figures 10 and 11. The pallets e^1, f^1, worked vertically by the lever G, by coming in contact with the stop pieces *a*, *a*, will allow the cylinder A, B, to turn by intermittent motions to the extent of about one-sixth of an inch under the points *v*, v^1. If on the periphery of the wheel A, B, a metallized sheet has been placed bearing an original telegram written in Morse's characters traced in pen and ink, exactly upon parallel lines, at a distance from each other of about one-fifth of an inch, and a strip of paper saturated with a solution of ferrocyanide of potassium has been placed upon a similar cylinder situate at the other station, the result will be that every time the platinum point gliding over the surface of the tinned paper comes in contact with ink lines, the current of the battery K will pass to the other station, and reproduce faithfully upon the chemically prepared paper wound upon the periphery of the cylinder A, B, all the points and strokes composing the despatch. In this manner a most exact copy of telegrams written on Morse's plan may be rapidly obtained.

Having now set forth the nature of the Invention of "Improvements in the Construction of and Mode of Working Telegraphic Apparatus," as communicated to me by my foreign correspondent, I wish it to be understood that under the above in part recited Letters Patent, I claim,—

First, the general arrangement of parts above described, whereby synchronous oscillations in the pendulums of transmitting and receiving instruments are ensured, and counterparts or copies of different messages or designs are simultaneously reproduced by the receiving instrument through the agency of electric currents passing through a single line wire.

Secondly, the novel arrangement of apparatus above described, applicable mainly to the reproduction of messages written in Morse or similar telegraphic characters.

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And, lastly, the means above described for ensuring distinctness in the characters or designs transmitted through instruments acting sychronously, as above described.

In witness whereof, I, the said Alfred Vincent Newton, have hereunto set my hand and seal, the Twenty-fifth day of March, in the year of our Lord One thousand eight hundred and sixty-two.

A. V. NEWTON. (L.S.)

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1862.

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FIG. 8.

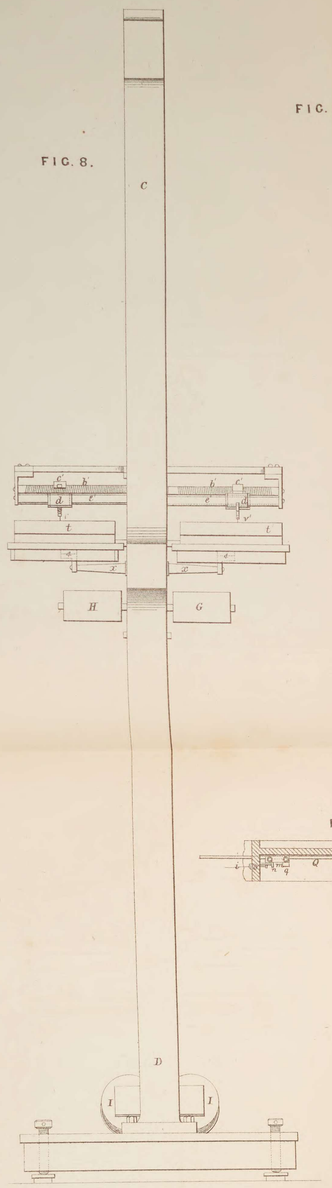


FIG. 1.

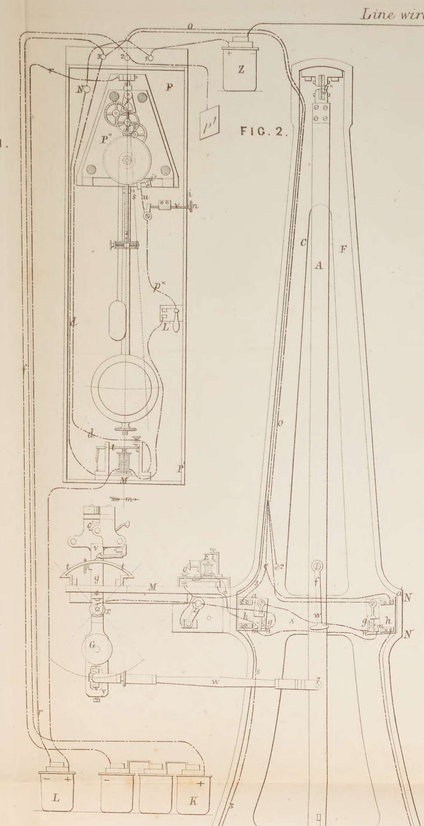


FIG. 2.

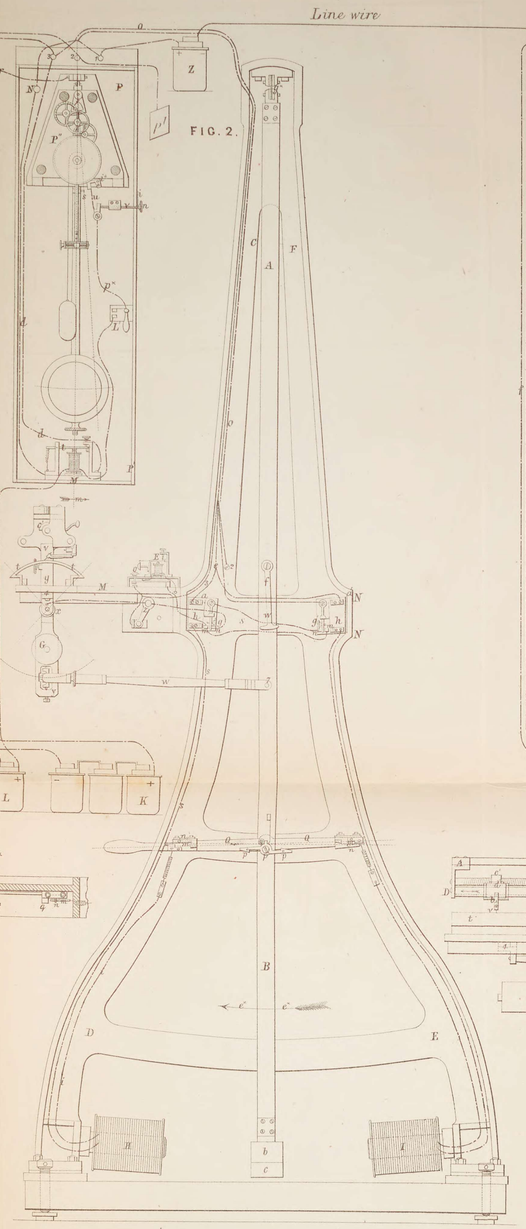


FIG. 4.

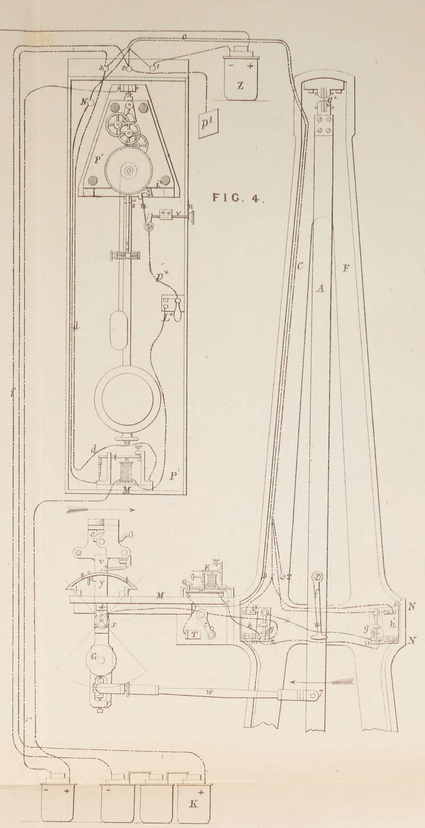


FIG. 7*

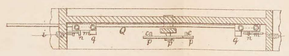


FIG. 5.

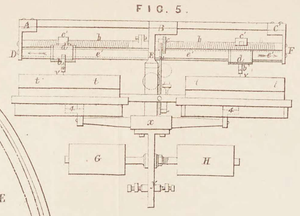


FIG. 6.

FIG. 7.

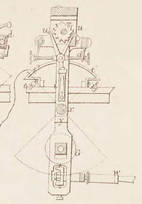


FIG. 9.

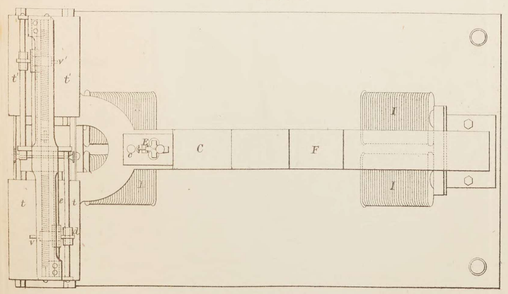


FIG. 11.

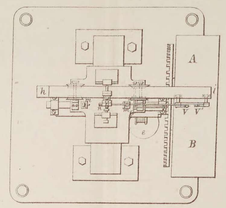


FIG. 12.

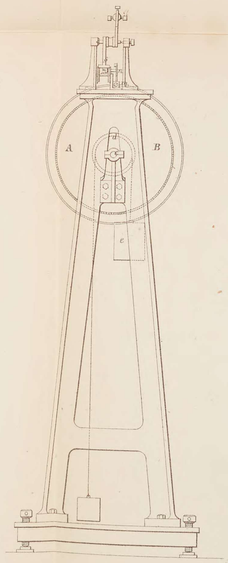
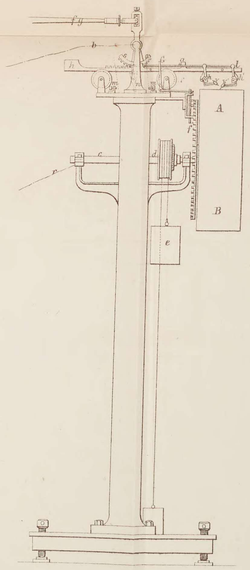


FIG. 10.



The filed drawing is partly colored.

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